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TERRACING FARM LANDS

SOIL EROSION, which annually causes enormous losses to the farmers of the United States, is most effectively controlled on moderate slopes by terracing. Two classes of terrace—the Mangum and the level types—are generally found best adapted to conditions in the United States. The Mangum terrace is a broad-base, ridge type of terrace with a variable grade; the level terrace is similar except that it has no grade or fall. Both can be crossed readily by modern farm machinery and without injury to the terraces. They may be planted to crops and cultivated together with the rest of the field. No other type of terrace presents these advantages.

The level terrace most nearly meets the requirements of the ideal terrace. Its distinct advantage over the Mangum terrace is that it holds practically all of the soil and fertility on the field. It is particularly adapted to deep, open, permeable soils. When used in connection with tile drains it can be employed on any type of soil, and unquestionably is the most effective method known to check erosion.

The Mangum terrace possesses all the advantages of the level type, except in the degree to which it retains on the field such soil as is picked up by the water. With this type a large part of the rainfall runs off the field, carrying with it some of the fertility. The Mangum terrace can be used on any type of soil, but is particularly recommended where the level terrace can not be used successfully without tile drainage.

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TERRACING FARM LANDS [1]

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SOIL EROSION, or the washing away of earth by water, is estimated to cost the farmers of the United States $200,000,000 every year. Soil losses from this cause occur in every State of the Union and in almost every county of every State. In 1927, H. H. Bennett, of the Bureau of Chemistry and Soils, United States Department of Agriculture, estimated that not less than 10,000,000 acres of formerly cultivated land has been rendered permanently unproductive by soil erosion and an additional 3,000,000 acres of formerly productive bottom land has been made worthless or seriously impaired by overwash of more or less inert sands and gravels deposited from flood, and by increased swampiness due to increased overflow caused by the clogging of stream channels with silt, sand, and gravel. So serious is the condition that N. S. Shaler, formerly dean of the Lawrence Scientific School, was once moved to remark that if mankind can not devise and enforce ways of dealing with the earth which will preserve this source of life, "we must look forward to the time—remote it may be, yet clearly discernible—when our kind, having wasted its greatest inheritance, will fade from the earth because of the ruin it has accomplished." [2]

Erosion injures or practically ruins fertile lands in a number of ways. The upper and most fertile parts of the soil are washed away until the land becomes barren and unproductive. (Fig. 1.) Deep gullies are formed which mean an actual loss of cultivable land area, and result in a lowering of the water table and a deficient supply of moisture. (Fig. 2.) Drainage ditches often become filled with sand, which frequently results in the flooding of the adjoining bottom land and the destruction of crops. (Fig. 3.) Rich bottom lands often are covered by deposits of sand washed from the hill lands. (Fig. 4.) Hence, the direct erosion losses of the upland farmer are the loss of the land area occupied by gullies, smaller crop

[1] It is recommended that this bulletin be read in conjunction with Farmers' Bulletin 1234, "Gullies, How to Control and Reclaim Them."

[2] DANA, S. T. FARMS, FORESTS, AND EROSION. U. S. Dept. Agr. Yearbook 1916: 107–134, illus. 1917.

yields each year, and continued decrease in the market value of the land. Some of the losses suffered by the bottom-land farmer are, cultivable land covered with sand, crops damaged by overflows or deposits of sand, continued decrease in the market value of the land,

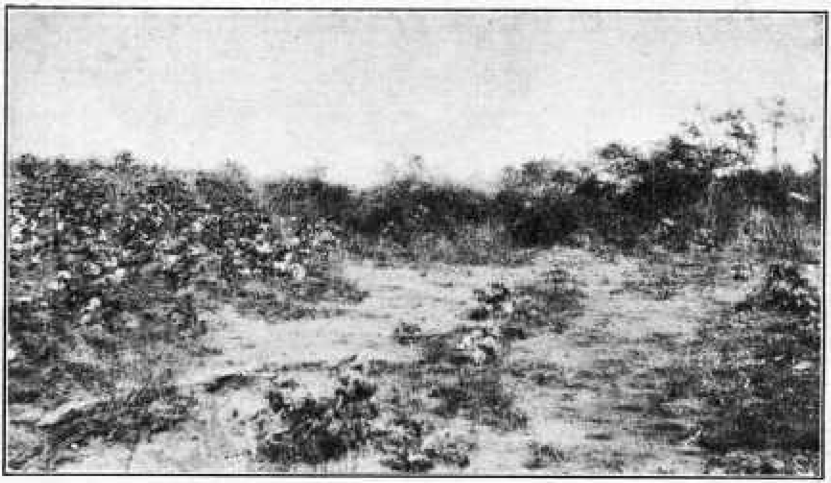

FIG. 1.—Sheet washing in which upper and most fertile parts of the soil are washed away

and the money invested in the construction of drainage ditches that have been wholly or partly filled with sand. Thus it is clear that both the bottom-land farmer and the upland farmer should be concerned in effective measures for checking erosion.

FIG. 2.—Gullying, which causes a loss of land and a lowering of the water table

CAUSES AND FORMS OF EROSION

Erosion is caused chiefly by the direct action of heavy rains beating upon the ground; by the rapid movement of the rain water down

the slopes of the land surface; and by the combined action of the freezing and thawing of a saturated soil, followed by heavy rains. (Fig. 5.) The steeper the slope the greater is the erosive action

FIG. 3.—Drainage ditch partly filled with sand washed from eroding hills

of running water. For instance, if the slope be increased four times, the velocity of the water down the slope is about doubled and the power of the water to carry away soil particles is increased about 32 times. Rows that run up and down the slope, when cultivated

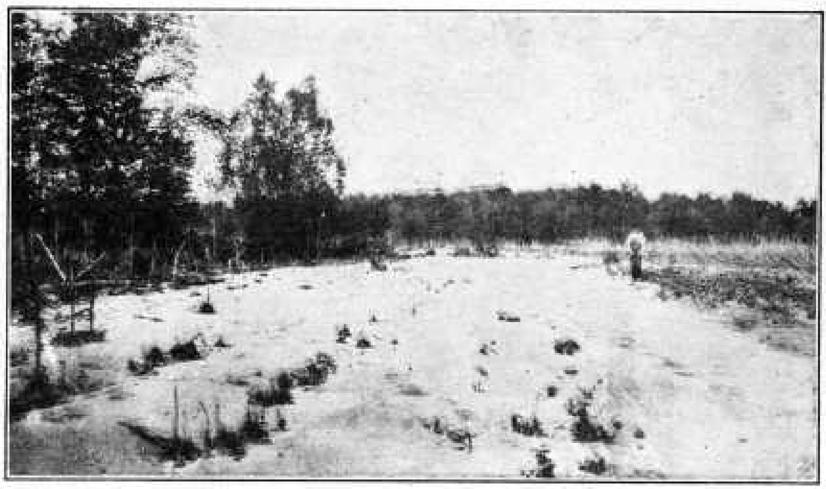

FIG. 4.—Portion of cornfield covered with sand washed from hill lands. This deposit of sand is the result of one heavy rain

form small ditches that concentrate the water and increase the amount of erosion. (Fig. 6.)

Where the moving water is quite uniformly distributed over the surface, the upper soil is washed away over wide areas; this form of

erosion is known as sheet washing. (Fig. 1.) Where channels are washed down the slopes, by large volumes of water flowing over narrow strips of ground, gullying occurs. This type of erosion generally begins in depressions or "draws." (Fig. 2.) Sheet wash-

FIG. 5.—Broad gully washing in very silty soils. On this type sheet erosion, having removed the surface soil, is followed by exceedingly destructive gullying over broad areas

ing is not so noticeable as gullying, and for that reason many farmers do not consider it very harmful. However, it is very destructive, since it robs the land of the surface soil, which is known to contain a higher percentage of plant food than does the subsoil. Also, it is practically impossible to obtain the full benefit of expensive

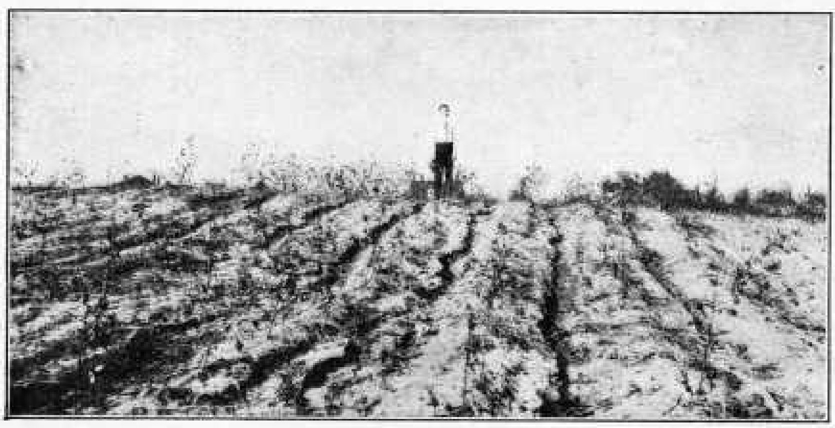

FIG. 6.—Erosion between cotton rows where rows are run directly up and down the slope, a practice which is responsible for a large percentage of badly eroded lands

fertilizers and manure where sheet washing occurs, since they are rapidly washed away along with the surface soil. If sheet washing were prevented, few gullies would ever be formed in a field, since sheet washing finally develops into gullying.

METHODS OF PREVENTING EROSION

Since erosion is caused largely by the rapid movement of rain water over the surface of the ground, methods of preventing erosion must be directed toward causing the water either to sink into the soil or to flow away slowly over the surface to a drainage channel.

In order to take up surface water rapidly a soil must be very permeable, which means that it must contain fairly large open spaces through which the rain water can pass easily, or in which it can be stored temporarily. Some soils are naturally very permeable; those that are not can be rendered more permeable by deep plowing; by plowing under organic matter such as manure, stubble, stalks, and cover crops; and by the practice of tile drainage.

Vegetation which covers the surface of the ground protects the soil from the direct action of the rain and checks the flow of water over the surface, thus giving the soil a better chance to absorb the water. It is therefore important that some kind of cover crop such as vetch, clover, oats, wheat, or rye, be grown on the land during the winter or at any time that the land is not used for other crops.

Contour plowing—which consists of breaking the ground along level lines across the slopes—reduces the flow of water directly down the slope. In planting and cultivating the crops the same level lines are followed, so that a shallow trough is made above each row, which catches and holds some of the rain water until it is absorbed by the soil. Contour plowing should invariably be practiced on all hill lands. A great many gullies are caused in the beginning by the practice of plowing and cultivating directly up and down the slopes. (Fig. 6.)

Terracing is the most effective method of preventing erosion, and it is doubly effective when all of the above precautions are employed in connection with it.

THE MANGUM TERRACE

While there are several different types of terraces, each suited to some special conditions, the type best adapted to use in the United States is the one commonly called the Mangum terrace. This consists of a broad ridge of earth thrown up across the hillside and having, in the direction of its length, a slope or fall to carry the surface water to the outlet channels at its ends. (Fig. 7.) This fall is slight at the upper end, but constantly increases toward the outlet end of the terrace. In throwing up this ridge a broad, shallow channel is formed along its upper side, through which the collected water flows at low velocity. (Fig. 8.) The entire terrace is cultivated, and on moderate slopes the crop rows may run at an angle across the terraces. (Fig. 9.)

The dotted line a–b in Figure 10 shows how high the water above the terrace may rise before the terrace is overtopped. The top of the terrace should be from 15 to 24 inches higher than the bottom of the channel on the uphill side of the terrace. This height is shown as c–d in Figure 10. The terrace should be built from 15 to 25 feet broad at the base, the wider terrace being the more desirable. The width may be increased each year by throwing the soil to the center of the terrace in plowing, until, on moderate slopes, the lower edge

of one terrace meets the upper edge of the next terrace below, and the whole field, as often happens, becomes a series of terraces.

In most soils it has been found that washing in the channel of the Mangum terrace takes place when the grade or fall of the terrace is greater than 6 inches in 100 feet, and even with this fall some of the fertile parts of the soil are carried away by the water. It is there-

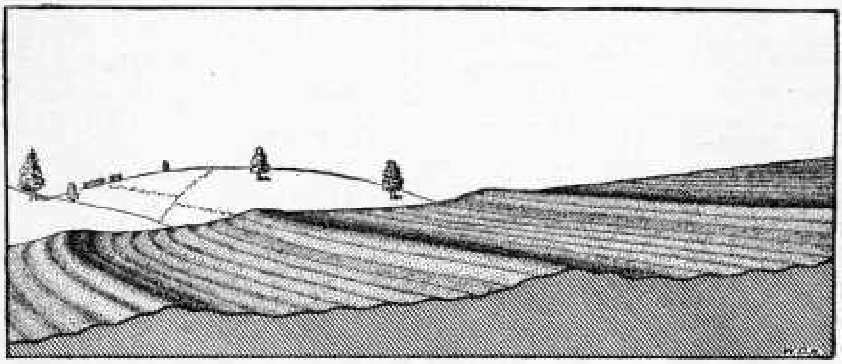

FIG. 7.—Mangum terraces. These are simply ridges of earth thrown up across the hillside and given a slight slope in the direction of the terrace to carry off the water

fore advisable that there be as little fall as possible and never more than 6 inches in 100 feet.

The fall of the terrace in a length of 100 feet is spoken of as the grade of the terrace; and the grade may be either uniform or variable, but strictly speaking the term Mangum terrace is applied to those having a variable grade, increasing from the upper to the

FIG. 8.—Water flowing off in a broad, shallow channel of a Mangum terrace. (From Bul. B–23, Agr. and Mech. Coll. of Texas)

lower end of the terrace. The variable-graded or Mangum terrace is much superior to a terrace with uniform grade, since it removes the surface water with less washing in the terrace channel and with less probability that the terrace will break near the lower end because of the piling up or concentration of the run-off water. By giving the terrace less fall near the upper end, the tendency is to store or

hold back the upper water until the water below has a chance to flow off.

FIG. 9.—Rows crossing Mangum terraces. Where this practice is followed considerable attention should be given to maintaining the terraces

A good practice is to change the grade every 300 feet along the length of the terrace. Table 1 gives the fall in inches per 100 feet for use in laying out Mangum terraces.

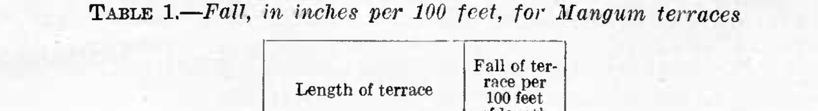

FIG. 10.—How water is ponded above a terrace

TABLE 1.—*Fall, in inches per 100 feet, for Mangum terraces*

Length of terrace	Fall of terrace per 100 feet of length
Feet	*Inches*
0 to 300	½
300 to 600	1
600 to 900	2
900 to 1,200	4
1,200 to 1,500	6

If it is necessary to lay out a terrace longer than 1,500 feet it should be built higher for the additional length near the lower end, or the terraces should be placed closer together. Either of these precautions is preferable to increasing the fall above 6 inches per 100 feet.

The vertical distance, or drop, between terraces depends principally upon the slope of the land. Terraces should be spaced close enough to prevent washing between them. Table 2 gives the vertical distances between terraces recommended for use on different slopes.

TABLE 2.—*Vertical distance between terraces*

Slope of land per 100 feet	Vertical distance or drop between terraces
Feet	*Feet*
3	3
5	3½
7	4
10	4½

Where the soil is extremely susceptible to erosion so that washing is likely to occur between the terraces, the vertical distances given in Table 2 should be decreased by one-half foot. On the other hand, if the soil contains considerable humus and is capable of absorbing a large part of the rainfall so that it is not easily eroded, the vertical distance may safely be increased one-half foot.

Where modern machinery is used in cultivating the land, the Mangum terrace is adapted for use on slopes of up to 10 feet fall in 100 feet. On steeper slopes there is difficulty in crossing these terraces with machinery. Where such equipment is not used Mangum terraces have in certain instances proved successful on slopes having as much as 15 feet fall in 100 feet. However, as a general rule it is advisable to leave slopes with a fall exceeding 12 feet in 100 feet in hay, pasture, or timber.

Failure of Mangum terraces occurs most commonly at sharp bends, at crossings of draws or gullies, and at points where either an abrupt reduction in grade or size of channel has been made. Breaks at bends are caused by water washing against the terrace and cutting through the embankment of earth and occur commonly where the terrace has considerable fall and the water a high velocity. Such breaks may be prevented by seeding the terraces to grass at bends and on areas where there are quick changes in grade and thus leaving them uncultivated. Breaks at crossings of gullies or draws are usually caused by failure to build the top of the terrace to the proper height across such places or by not making proper allowance for the settlement of the terrace. The grade of the top of the terrace leading into a draw never should be greater—and preferably should be less—than the grade of the top leading out, because a greater grade would result in much more water being brought into the draw than could be carried out on the lighter grade.

THE LEVEL TERRACE

In all terraced fields some washing is bound to occur on the slopes between the terraces. The rich soil particles washed from the slopes collect in the channel above the lower terrace. If the terrace has fall, part of the soil is carried off with the water, the amount depending on the fall given the terrace. If the terrace is level, practically all the soil remains on the field. From this it is seen that a terrace should have no more fall than is absolutely necessary, and wherever conditions will permit, it should be level. The level terrace is particularly adapted to land composed of deep, porous soils.

The level terrace is built in the same manner and to the same dimensions as the Mangum terrace, except that it has no fall to

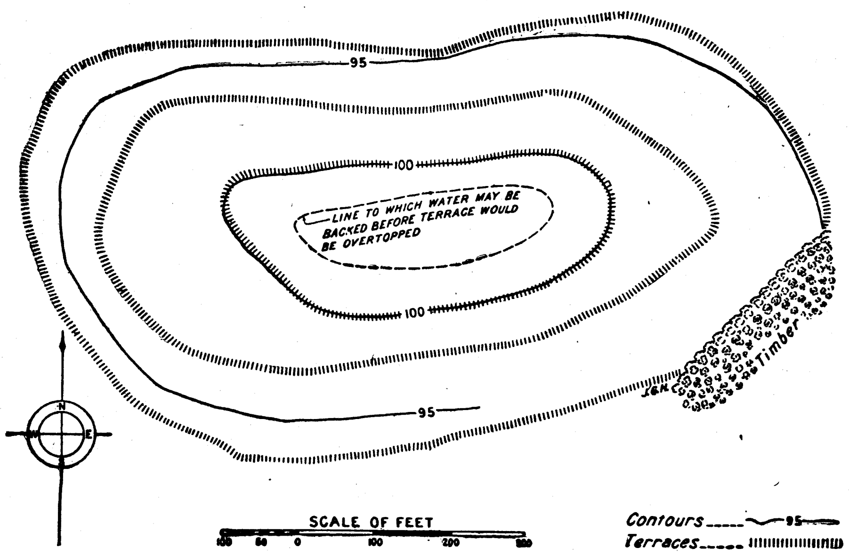

FIG. 11.—An example of level terraces encircling the top of a knoll

carry off the water. The rain that falls between the terraces is collected and held above the lower terrace until it evaporates, sinks into the soil, or finds its way slowly to an outlet at the ends of the terrace.

The ends of level terraces may be closed to prevent the escape of any of the surface water or may be left open to allow the water to pass away slowly. If the soil in a field is capable of absorbing all of the rainfall so as to leave no water standing on the surface long enough to injure crops the ends are closed, otherwise they are left open. Where the ends are closed the terraces should be built at least 18 inches high. In Figure 11 is shown a plan view of a terraced field where two of the upper terraces completely encircle the top of a hill there being no way for the water to escape over the surface to a drainage outlet. These terraces have given complete satisfaction.

The proper drops, or vertical distances between level terraces, for several kinds of soil are given in Table 3, it being assumed in each

case that the soil is deeply plowed, contains considerable humus, and is capable of absorbing a large part of the rainfall.

TABLE 3.—*Vertical distance, or drop, between level terraces for different types of soil*

Type of soil	Vertical distance, or drop, between terraces
	Feet
Sandy	4½
Sandy loam	3½
Clay loam	2½
Clay	2

In crossing a gully or draw in a field it is almost impossible to prevent the formation of pockets above the terrace that tend to hold the water on the surface. To remove the water that stands in such pockets it is recommended that tile be laid down the middle of the

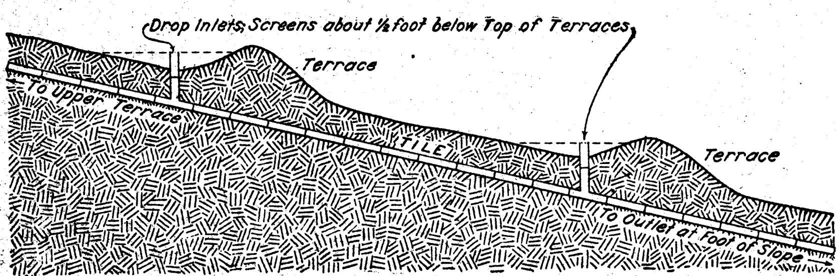

FIG. 12.—Method of removing water standing above terraces in a gully or draw

draw to a drainage outlet at the foot of the slope. A profile view of a tile line laid in a draw and provided with a drop inlet above each terrace is shown in Figure 12. The use of the drop inlets allows particles of soil in the water to settle before the water is drained away.

In regions of light rainfall, or where crops suffer severely from drought, level terraces are especially effective in retaining a supply of moisture which is often much needed on hill lands during the growing season and during periods of drought.

COMBINED SYSTEM OF LEVEL TERRACES AND TILE DRAINAGE

Some farmers who fully realize the importance and value of completely checking erosion on their farms have gone to the expense of installing complete systems of tile drainage in connection with systems of level terraces. This unquestionably is the most effective method known to hold in place the soil of a hill farm, and its value can not be overemphasized. In a combined terrace and tile-drainage system the lateral tile drains are laid in the depressions along the upper side of the terraces and connect with main tile drains that are generally laid down the center of gullies or draws to a drainage

outlet at the foot of the slope. If the surface water does not pass rapidly through the soil to the tile drain it may be necessary to build surface inlets at intervals in the lateral tile lines to afford a direct flow of the surface water into the tile.

It is advisable to employ the services of a competent and experienced engineer to design and superintend the construction of a combined terrace and tile-drainage system. Instructions for the construction of tile drains and other information relating to the proper design and construction of tile systems can be obtained free upon application to the Bureau of Public Roads, United States Department of Agriculture, Washington, D. C.

TERRACE OUTLETS

The provision of suitable outlets for the removal of surface water at the ends of graded terraces is often the biggest problem in terracing work. Natural watercourses make ideal outlets. However, they are not always available because the disposal of the water is generally limited to the field that is being terraced. To make the best use of natural drainage outlets, it is often advisable for neighboring farmers to cooperate in terracing adjoining fields. Where this is done, the terraces can be run across the property lines and there will be no cause for the development of gullies at such lines as is often the case when it is necessary to end the terraces there.

The side ditches along farm roads are often used for terrace outlets. Where they are not protected in some way, bad washing may occur and cause considerable injury to the road. When it is desired to use the side ditches along the public highway as the outlet for water from terraces, the officials in charge of the highway should be consulted before any work is done, so that possible injury to highways may be avoided. This washing may be prevented by building dams of brush, rock, or concrete across the ditches at suitable intervals down the slope, or by lining the ditches with some hard material such as stone or concrete. Usually, where a terrace discharges into a roadside ditch a considerable drop of the water occurs at the end of the terrace; in that case a gully invariably forms along the upper side of the terrace. This can be prevented by the use of a wooden-box trough which discharges the water with a free overfall into the ditch at the end of the terrace. Sometimes a protection for both the terrace channel and the ditch is built of concrete.

Erosion is most active near the end of a terrace where the largest flow of water occurs. For this reason the last 25 to 50 feet of the terrace should not be cultivated, and the terrace and terrace channel should be seeded to grass for protection against erosion.

Sometimes it is found necessary to use a natural draw in a field as a terrace outlet. Where this is the case the draw should either be seeded to grass (fig. 13) or some other means—such as the soil-saving dam—should be employed to prevent the erosion of a deep gully. Farmers' Bulletin 1234[3] contains descriptions of soil-saving dams.

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[3] RAMSER, C. E. GULLIES: HOW TO CONTROL AND RECLAIM THEM. U. S. Dept. Agr. Farmers' Bul. 1234, 44 pp., illus. 1922.

LAYING OFF TERRACES

In laying off a system of terraces it is first necessary to provide for suitable outlets. Wherever possible, outlets should be placed at both ends of the terraces. This divides the water of the field and gives each terrace the minimum quantity to handle. Short terraces are less likely to break than long ones and are, therefore, more desirable.

When a draw or depression occurs near the middle of the field it is desirable to begin the terraces in the draw, so as to avoid building a high embankment such as would be required for carrying the water across the draw. Of course, the possibility of doing this depends upon the size of the draw. Sometimes it is found necessary to use such a draw as a terrace outlet where suitable outlets are not available at the border of the field.

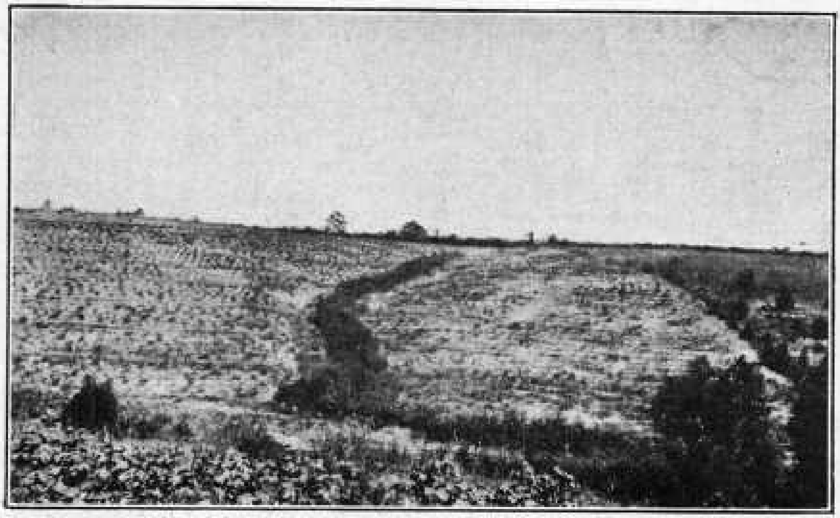

FIG. 13.—Terrace outlet in draw, seeded to grass to prevent erosion

It is always best to lay out the uppermost terrace first. A starting or reference point for this terrace should first be fixed by measuring down the proper vertical distance from the top of the hill or the highest point in the field. If a terrace midway down the slope is laid out first, and a point from which to start is selected at random without respect to the top of the hill, the chances are that the upper terrace will drain either too large or too small an area. If it is made to drain too large an area—which is a very common mistake in terracing—the excessively large volume of drainage water generally breaks the upper terrace, and usually all the terraces below are then broken in turn. If the upper part of a hill belongs to a neighbor an effort should be made to induce him to terrace it. Otherwise it will be necessary to dig a hillside ditch or an embankment along the upper side of the field to intercept the water draining from the neighboring farm above.

Homemade instruments are often used for laying off the terrace lines—such as the A frame with plumb bob or spirit level—but unless

the work is done very carefully the results are generally poor. A farm level, costing about $20 (fig. 14), is widely used, and any intelligent person with care can obtain good results with this instrument.

The field work required in laying off a system of Mangum terraces is as follows: Set the leveling instrument about midway between the ends of the uppermost terrace, and high enough so that when it is level the line of sight will pass over the highest point in the field. Have an assistant hold the rod on this highest point and read the rod there and also at a point 50 feet directly down the slope. Twice the difference between the rod readings obtained is the slope of the land in 100 feet, in that part of the field. From Table 2 find the recommended vertical distance, or drop, between terraces for that slope.

Example:

	Feet	Inches
Rod reading at top of field	1	0
Rod reading 50 feet down the slope	4	6
Difference in rod readings	3	6
Twice the difference in rod readings or slope of land in 100 feet	7	0

According to Table 2 the vertical distance or drop between the top of the field and the first terrace in this case should be 4 feet.

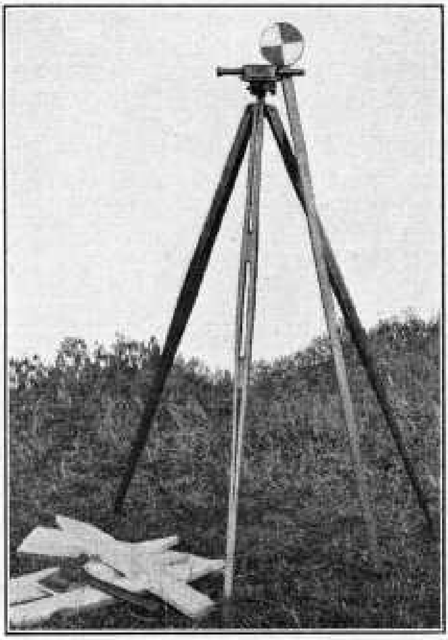

FIG. 14.—Farm level and rod widely used in laying off terraces

Set the target on the rod at 5 feet (which is 4 feet above the rod reading at the top of the hill). Have the rodman move the rod down the hill until the line of sight through the telescope strikes the center of the target. The point thus located is 4 feet below the top and therefore is the starting point on the first terrace, providing an outlet is available at each end.

From this point, locate the line of the terrace in both directions, giving it the fall or grade shown in Table 1. To do this the rodman sets the target at 5 feet, one-fourth inch (in the example above), moves 50 feet along the side of the hill, and is directed up or down the slope by the man at the instrument until the line of sight through the instrument strikes the center of the target. The point on which the rod rests is one-fourth inch lower than the starting point and therefore is the second point on the terrace. The target is then moved up another one-fourth inch, the rod carried on 50 feet farther and the third point located in the same manner. In accordance with Table 1, after the first 300 feet of terrace has been located the target should be raised one-half inch (instead of one-fourth inch) for

each 50 feet; after 600 feet, 1 inch; after 900 feet, 2 inches; and after 1,200 feet, 3 inches, to the end of the terrace. A terrace should not carry water more than 1,500 feet in one direction if it can be avoided. If a longer terrace is necessary the grade should not be increased above 3 inches in 50 feet, but the lower end of the terrace should be built to extra height to take care of the excess water.

After the uppermost terrace has been located from the middle of the field toward one outlet, the next step is to locate the other half of this terrace in exactly the same manner.

Sometimes it is impossible to provide an outlet at each end of a terrace; it is then necessary to carry all the water to an outlet at one end. Under such conditions the terrace should not exceed 1,500 feet in length, unless the lower end is given an extra height, as before mentioned. In the above example the rod reading on the first point located on the terrace line was 5 feet. Use this point as a reference point although it may not prove to be exactly on the terrace line because in this case locating starts at the edge of the field. Lower the target 6 inches (or to 4 feet, 6 inches) and have the rodman carry the rod to edge of the field at the upper end of the proposed terrace and move it up or down the slope until the line of sight through the instrument strikes the center of the target on the rod. This is the starting point for the terrace and is 6 inches higher than the reference point. The purpose of starting the terrace 6 inches higher than the reference point in the middle of the field is to insure that the terrace line shall pass close to the reference point in the middle of the field. It is evident—since the terrace line continually falls—that if it were started at the same elevation as that of the reference point, the line would fall below the reference point by the time the middle of the field is reached. The terrace can now be laid off by raising the target each 50 feet exactly as described in the previous example.

Before starting to locate the second terrace, the slope of the land should again be measured. Read the rod at a point on the first terrace line about midway between its ends. Measure 50 feet directly down the slope and read the rod at this point. It will sometimes be necessary to reset the instrument farther down the hill before this can be done. If the instrument is moved, both readings must be taken from the new position. Having determined the slope of the land, refer again to Table 2 to find the proper vertical drop between the terraces for the new slope and proceed in the same manner as with the first terrace.

The level terrace is much simpler to lay off than the Mangum terrace because—since it has no fall—it is not necessary to measure distances along the terrace line. The reference point should be located, as in the case of the Mangum terrace, and the terrace line run in both directions through this point. The rod reading will be the same for all points on the terrace as long as it is not necessary to shift the instrument.

In terracing work distances are measured by pacing. In pacing the distances the rodman should try to estimate as nearly as possible where the next point will be, and when directed up or down the hill by the levelman should keep the proper distance from the last point. To avoid mistakes the rodman should always change the

target before starting to pace off the distance. If the field has been cultivated in ridges, the points should be located by setting the rod either always on top of the ridges or always in the depressions between them. If after the proper distance between points on the terrace line has been determined it is found that the rod is too low when set in a depression between the ridges and too high when set in the next depression above, then the proper location for the line of the terrace lies between the two positions of the rod.

A man should accompany the rodman and set stakes at points on the proposed terrace lines. A plowman should follow immediately and lay out the first furrow. Care should be taken to see that no abrupt turns are made with the plow. All changes in direction should be made by smooth, regular curves. Where gullies or draws are crossed, stakes should be set on each side and the terrace run directly across.

Long sights with the level (exceeding 500 or 600 feet) should be avoided. Much more accurate results are obtained where short sights are taken. When it becomes necessary to move the level so as to

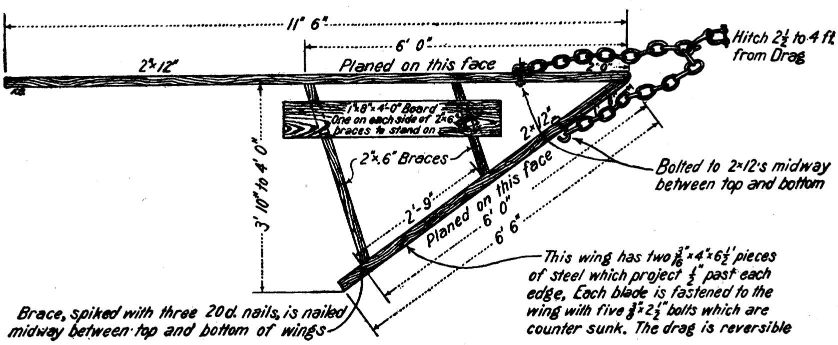

FIG. 15.—View of homemade wooden V drag used for throwing up terraces

avoid taking long sights or in order to see around a hill, the rodman should remain holding his rod exactly on the last point located. When the level is set up at the new position the rodman raises or lowers the target so that it coincides with the new line of sight of the level and the work proceeds as already described.

BUILDING TERRACES

The plow and the V-shaped drag are the most generally used implements for building terraces. In Figure 15 is shown a plan view of a terrace drag widely used in Texas. This drag is very easily built. The use of a steel ditcher or terracer has been found to be very effective and satisfactory. Two types of this implement are shown in Figures 16 and 17.

In terracing a field, the uppermost terrace should always be built first. If a lower terrace is built first and there is not time to build the upper ones before a rain comes, the lower terrace is likely to be badly washed and broken by the large volume of water drained from all the land above.

FIG. 16.—A steel ditcher and terracer. Four horses are generally used with this implement in terracing work

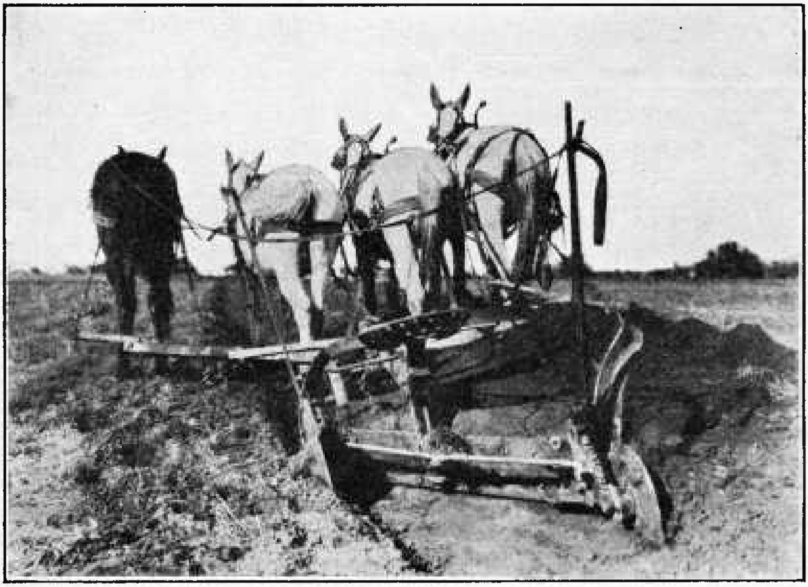

FIG. 17.—A steel ditcher and terracer with steel disks at each end of adjustable cutting blade and moldboard

In building the terrace a backfurrow strip about four furrows wide is first thrown up as shown in Figure 18. The steel terracer or V drag, drawn by four horses, is then used to move the dirt toward the center of the strip and as high as possible. The plowing is then continued, and the best results are obtained where each round with the plow is followed with the terracer. For the best results the weight of two men is required on the V drag. They can shift their weight so as to raise or lower the end of the short wing as desired. The process of plowing and dragging is continued until the terrace is from 15 to 25 feet wide. If the terrace is not high enough after it has settled—as found by testing the height in a number of places with a level—the plowing and dragging should be repeated. A view of a freshly-built terrace is shown in Figure 19.

Terraces are sometimes built with a plow alone. Several plowings are required to throw up the terrace to the desired height. A large

FIG. 18.—The first step in building a terrace is to backfurrow a strip about four furrows wide

16-inch plow with an extra-large wing attached to the moldboard may be used very successfully for throwing up high terrace embankments. The disk plow and the ordinary road grader are very effective for the purpose. Mangum terraces on steep slopes are often built with a plow and a fresno slip scraper. In this case a strip is backfurrowed with the plow and the loose earth on the upper half of the strip is scraped up and dumped on the lower half. By this method the terrace is built up mostly of soil moved down from the upper side.

In order to finish terraces properly some work with the scraper is generally required. The top of the terrace should be tested with the level and rod to see that it conforms to the proper grade. Any low places detected should be filled with the shovel or scraper. All large embankments across draws and gullies should be built with the scraper and it is necessary to build such embankments considerably higher than the rest of the terrace to allow for settlement. Most

breaks in terrace systems occur at crossings of gullies or draws and it is therefore very important that a high, broad, substantial embankment be built across these places.

Any obstructions—such as rocks, stones, and stumps—that lie along the line of the terrace should be removed, since their presence might permit seepage and result in the failure of the terrace. In some parts of Texas the fields contain numerous large earth mounds generally known as gas mounds. These mounds cause considerable difficulty in terracing fields. Where they lie along the lines of graded terraces it becomes necessary to provide a passageway through them by means of the plow and scraper.

Where terraces are continued from one field to another across a fence row it is necessary to build those sections of the terraces near the fence by hand labor, using the spade and shovel. It is very important that such parts of the terrace and channel be built of the same size as the rest of the terrace and considerable attention should

FIG. 19.—View of a newly completed Mangum-ridge terrace

be given later to see that the waterway is always kept open so that the free flow of the water shall in no way be obstructed.

The old maxim, "what is worth doing at all is worth doing well," is especially applicable to terracing work. If one has not time to terrace all of a field properly it is far better to terrace the upper part well than to attempt to terrace the whole field and do a poor job.

CARE AND CULTIVATION OF TERRACES

Terraces require considerable care and attention, especially during the first year, before the loose soil has had time to become thoroughly settled. All apparently weak places should be visited after every heavy rain, and any breaks that occur should be repaired immediately. It is best not to cultivate the terraces the first year, but to seed them to some kind of cover crop. (Fig. 20.)

On steep slopes it is advisable to run the crop rows parallel with the terraces, one row being on the top of the terrace. The cultivation of the top row tends to keep the top of the terrace at the proper height. Where the rows are run across the terraces—as is done

commonly on moderate slopes—the terraces tend to flatten out when cultivated, and more maintenance work is required than where the rows are run parallel with the terraces.

All terraces that are cultivated should be plowed at least once a year, and the soil should be thrown to the center. In this way the height of the terrace is maintained and the base broadened each year.

Steep land that washes badly between the terraces should not be cultivated. The terraces should first be well built and then the entire field seeded to grass and used for pasture or meadow.

When it is necessary for terraces to cross a farm road they should be constructed without regard to the road. Where the terraces are as much as 20 feet broad, no provision need be made for passing traffic across them, but they should be carefully maintained to prevent possible breaks. With narrower terraces, considerable inconvenience to traffic and injury to the terraces generally results where no provision for crossing is made. Sometimes the water is carried under the roadway by means of a culvert. The principal objection to this is

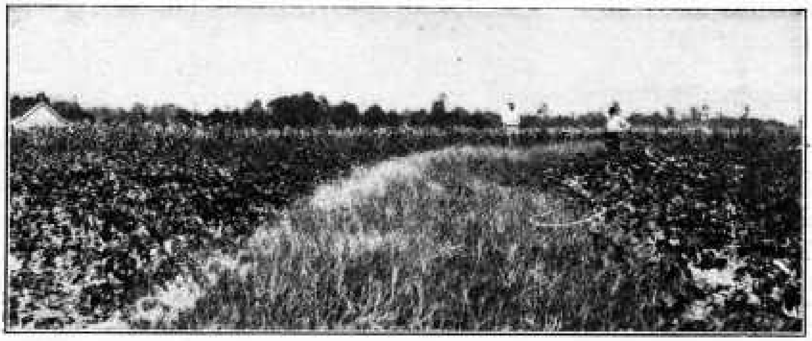

FIG. 20.—Newly built terrace seeded to cover crop to insure against breaking before the loose earth becomes thoroughly settled

that the capacity of the waterway is thus greatly reduced, and the free flow of the water through the culvert is often obstructed by stalks or other trash washed from the field. A wooden bridge spanning the channel so as not greatly to reduce the cross-sectional area of the waterway, makes a more desirable and satisfactory crossing.

Following the terracing of eroded or run-down land it is generally advisable to improve the soil for at least one year by the use of cover and soil-building crops rather than to attempt to grow a money crop on it immediately. The choice of crops for this purpose will depend upon locality, but for summer crops, soy beans, cow peas, and velvet beans are among those for primary consideration. As a winter cover crop to bind the soil and to add organic matter there is perhaps nothing that will equal rye and vetch. Manure, where available, should be used, especially on thinner spots, in order to secure greater uniformity of soil. It is believed that greater profits will be attained in the long run by first building up badly run-down soils, especially following terracing.

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